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(54) Device for applying an abrasive coating mass onto a moving paper web

(57) It is known that a coating mass that contains abrasive particles can be applied in excess onto a moving paper web by means of a slotted nozzle, metered by means of a metering roller, and leveled by means of a flap that is made of flexible material, is fastened on one side and lies slack upon the moving paper web. However, it has been shown that depending on the consistency of the coating mass, it is not always possible to successfully smooth a coating pattern that is uneven as a result of surface tension in such a way that an undesirable stripe pattern can no longer be seen.

With the new device, the leveling apparatus (8) includes a texturing roller (9), the enveloping surface of which has a screw thread-like pattern. As a result, the longitudinal stripes resulting from the uneven coating pattern are smeared laterally so that they can no longer be seen on the finished product.

[see figure] **Figure 1**

Description

[0001] The invention pertains to a device, in accordance with the pre-characterizing portion of Claim 1, for applying a coating mass consisting of a liquid resin and fine-grained abrasive material, corundum in particular, onto a moving paper web that is intended for use in the production of abrasion-resistant laminates.

[0002] DE 195 08 797 C1 describes a method for producing décor paper for use in producing abrasion-resistant laminates. To do this, a viscous mixture, which consists of melamine resin and alpha cellulose to which corundum particles are added, is applied as a coating mass to the visible surface of a décor paper. The alpha cellulose is used as a stiffening and suspending medium. The corundum particles have a grain size of 15 – 50 µm. The applied amount is 80 – 200 g/m^2, so that a layer thickness of 20 – 65 µm results after final dampness has been reached. The coating mass is to be applied by means of a wire doctor blade, a reverse coating system or an anilox roller.

[0003] Described in DE 198 14 212 C1 is a device that is intended specifically for applying such a coating mass. The invention builds upon this device, which has already been well-proven for some time on a commercial scale. With the known device, the metering roller is synchronized with the deflection roller so that the surface velocities of the two rollers in the metering gap match in size and direction. Thus, no relative velocity exists between the metering roller and the coating mass that is adhering to the paper web. This way, the wear on the metering roller caused by the abrasive particles in the coating mass is kept as small as possible. However, one gathers from the patent specification that the synchronized running of the two rollers causes a different problem: In the narrow gap between the metering roller and the deflection roller, the layer that is already adhering to the paper web – unlike the case where a metering roller is running in the opposite direction – is split, so that part of the coating mass remains adhered to the paper web, while another part is carried along by the metering roller. After the paper web has gone through the roller gap, the adhering layer is still uneven at first, so that longitudinal stripes are clearly visible. In order to eliminate the stripe pattern, a leveling apparatus is provided, and specifically, a doctor blade consisting of an essentially rectangular flap made of a flexible, rubber-like material that is fastened on one side at its rearward edge, which is parallel to the axes of the two rollers, to a holding strip, and lies slack on the wind-off upper free-running section of the paper web as it leaves the deflection roller.

[0004] Depending on the consistency of the coating mass, which can exhibit appreciable differences because of the various formulas used by the individual manufacturers, a flap of this type is not always adequate for rendering the unwanted stripe pattern completely invisible.

[0005] According to US Patent Specification 19 39 012, a worm is used for smoothing down the surface of moist green bricks. A form that is filled with moist loam is passed under the rotating worm. Excess loam is stripped off as this is done. It falls into a chute that is placed to the side and is sent for recycling.

[0006] DE 195 41 000 A1 describes a device for smoothing gypsum plaster boards that are passing through, consisting in essence of a worm that is placed across a conveyor belt for the passing gypsum plaster boards. In the manner of a scraper, the rotating worm clears away from the surface of the already set gypsum plaster boards which are passing under it, and which can be still moist or already dry, fine particles that are transported to the edge by the conveying action of the worm and fall into a container there.

[0007] The invention is based on the task of further developing a device in accordance with the pre-characterizing portion of Claim 1 in such a way that it supplies uniformly coated papers with no visible stripes, even if coating masses are used that are very hard to process.

[0008] According to the characterization of Claim 1, this task is carried out by means of the fact that the leveling device includes at least one texturing roller, the enveloping surface of which has a screw thread-like pattern.

[0009] Additional advantageous features of the invention are the object of Claims 2 through 10.

[0010] The drawing serves to explain the invention with the aid of embodiments shown in schematic form.

Figures 1 through 4 illustrate various devices in accordance with the invention.

Figures 5 through 7 illustrate various texturing rollers.

[0011] According to Figure 1, a paper web 1, which has already been pre-impregnated with resin and which may already be dry as well, is sent in the horizontal direction to a deflection roller 2. It wraps around the deflection roller 2 in the region of an arc of 180° that is approximately delimited in the 6 o'clock position by the wind-on line 3 and in the 12 o'clock position by the wind-off line 4. The paper web then runs in the horizontal direction as symbolized by the arrow 5 to a dryer, not shown.

[0012] Placed next to the deflection roller 2 is a metering roller 6 with a smooth jacket surface. In the embodiment that is shown, it has the same diameter as the deflection roller 2. The axles of the deflection roller 2 and the metering roller 6 are supported parallel to each other and at the same height on bearings in a machine frame, not shown. The bearing arrangement of one of the two rollers 2, 6 can be shifted in the horizontal direction so that the width of the narrow gap that exists between the two rollers 2, 6 is variable. Both the metering roller 6 and the deflection roller 2 are provided with a driving mechanism. The driving mechanisms of both rollers 2, 6 are mechanically or electrically coupled so that the rollers 2, 6 rotate synchronously or nearly synchronously, i.e., preferably with a matching surface velocity that corresponds to the transport velocity of the paper web.

[0013] A slotted nozzle 7 for applying the coating mass is placed under the deflection roller 2. The slotted nozzle 7 is adjacent to the wind-on line 3.

[0014] Placed above the wind-off upper free-running section of the paper web 1 at a short distance from the wind-off line 4 is a leveling device 8. It includes a texturing roller 9, and a smooth roller 10 that is placed behind the texturing roller 9 in the direction the web is running. The texturing roller 9 and the smooth roller 10 are adjustable in height, so that their distances from the paper web 1 can be varied. Placed at a short distance, which approximately corresponds to the distance of the roller 10 from the wind-on line 4 [sic], below the paper web 1 in the direction of the arrow 5 behind the leveling device 8 is a support roller 11.

[0015] The enveloping surface of the texturing roller 9 has a screw thread-like pattern. The texturing roller illustrated in Figure 5 is provided with a helical groove 12, which extends essentially across the entire length of the texturing roller 9 in accordance with the working width. The web 13 that remains between adjacent threads is rectangular in cross section and has about the same width as the groove 12. The enveloping surface thus has the structure of a single-start screw thread.

[0016] The texturing roller illustrated in Figure 6 differs from the above in that it is provided with a multiple-start screw thread, and specifically, with a triple-start screw thread. As a result, with no change to the cross section of the grooves and webs, the lead of the screw thread is increased accordingly, as is the lead angle.

[0017] The texturing roller illustrated in Figure 7 is provided with a system of helical grooves of the same pitch with opposing helical directions. The system includes three right-handed grooves and three left-handed grooves. The left-handed grooves correspond to the grooves illustrated in Figure 6. As a result of the other, crossing grooves, cut from the roller is a flat relief comprised of diamond-shaped islands 14 and somewhat reminiscent of a tile surface, one diagonal of which is aligned parallel to the axis of the roller. The second diagonal is at a right angle to that one.

[0018] In the device according to Figure 1, during operation the paper web 1 passes through at a velocity between approximately 10 and 70 m/min, preferably between 20 and 50 m/min. The coating mass, which consists of liquid resin with fine corundum particles suspended in it, is applied in excess via the slotted nozzle 7 directly onto the paper web from underneath. The layer that is formed in this way is split in the narrow gap between the deflection roller 2 and the metering roller 6 in such a way that part of the coating mass remains adhered to the paper, while the other part is carried along by the metering roller 6. Excess coating mass gets piled up in the gap and drips off. Because the surface velocities of the two rollers 2, 6 are in the same direction and preferably are of at least approximately equal size, the abrasive particles contained in the coating mass do not cause any appreciable wear on the metering roller 6.

[0019] The layer adhering to the paper web – approximately 30 to 100 g/m^2 on average – is uneven at first, so that longitudinal stripes are clearly visible. The stripes can be explained by the fact that during the splitting of the layer in the gap, as a result of surface tension the liquid coating mass tends to draw together into well-defined locations that are distributed more or less uniformly across the width. At these locations, the pattern of the layer adhering to the paper web has peaks that look like narrow stripes. The distance between two adjacent stripes is usually between approximately 10 and 30 mm. Moreover, this unwanted stripe pattern can change in unforeseeable ways.

[0020] The texturing roller 9 is adjusted in such a way that it makes contact with the paper web. In the version according to Figure 5 or Figure 6, the rapidly rotating texturing roller 9 – comparable to a worm – exerts on the coating mass that has accumulated in the stripes a conveying action in the direction of their axes, i.e., transversely to the paper web 1. The precondition is, of course, that the surface velocity of the texturing roller 9 in the region of contact differs substantially from the velocity at which the paper web 1 is moving in the direction of the arrow 5. Depending on the direction in which the texturing roller 9 is rotating and the direction of the screw thread, the conveying action is aligned unilaterally towards one or the other edge of the paper web. As a result of the conveying action, the concentrated stripes are, so to speak, smeared in the transverse direction. However, no coating mass is removed from the paper web 1. The texturing roller 9 thus has only a smoothing action, but no effect on the amount metered. For that reason – unlike the metering roller 6 – the texturing roller 9 does not require extreme dimensional accuracy. A certain amount of wear has scarcely any influence at all on the effectiveness of the texturing roller 9. As a result, the texturing roller 9 does not call for particularly high cost.

[0021] The downstream smooth roller 10, which also rotates at a high velocity, brings about additional smoothing.

[0022] Because of the deflection roller 2 and the support roller 11, which is placed at a relatively close distance, the slack in the paper web 1, which is usually under a certain amount of tension during operations, is reduced to an imperceptible size in the region of the leveling device 8.

[0023] With the device according to Figure 1, it is possible to use as the texturing roller 9 a roller with an enveloping surface which has the pattern illustrated in Figure 7. With it, the coating material that has accumulated into stripes is carried partly to one side and partly to the other by the front – when viewed in the direction of the surface velocity – edges of the diamond-shaped islands 14, which edges are at an oblique angle relative to the surface velocity. As a result, uniform distribution is achieved.

[0024] The embodiment illustrated in Figure 2 differs from the embodiment illustrated in Figure 1 in particular through the fact that the leveling device 8 includes two texturing rollers 9, 9a that are placed one behind the other. An additional difference consists in the fact that slotted nozzle 7 is assigned to the metering roller 6.

[0025] In the embodiment according to Figure 3, the leveling device includes a doctor blade 15, which is placed in front of the texturing roller 9 in the web path. It consists of an essentially rectangular flap 16 that is made of a flexible, rubber-like material that is fastened at its rearward edge on one side and parallel to the axis of the texturing roller 9 to a holding strip 17, and lies slack on the wind-off upper free-running section of the paper web 1 as it leaves the deflection roller 2. The flap 16 already brings about a certain preliminary leveling. In addition, the embodiment according to Figure 3 differs from the embodiments that were discussed earlier through the fact that a similar doctor blade 18 is assigned to the metering roller 6. The associated holding strip 19 is placed transversely over the metering roller 6, and specifically, on the side that is turned away from deflection roller 2. Suspended from it on one side is a flexible rectangular plastic flap 20. The front part of the flap lies slack on the metering roller 6. The coating mass that adheres to the metering roller 6 is leveled by the flap 20. This prevents an uneven pattern of the layer adhering to the metering roller 6 from being transferred onto the coating on the paper web 1.

[0026] The embodiment illustrated by Figure 3a differs from that of Figure 3 in that the doctor blade 15 is placed– as seen from the direction of travel – behind the texturing roller 9 so that the flap 16 lies on the paper web 1above the support roller 11. Any transverse stripes that can still be seen behind the texturing roller 9 are smoothed by the flap 16.

[0027] In the embodiment according to Figure 4, the metering roller 6 is placed almost vertically – about in the 11 o'clock position – above the deflection roller 2. As a result, between the metering and the leveling, the paper web covers only a relatively short distance, and needs only a correspondingly short period of time to do so. As experiments have shown, this has a positive effect on the leveling.

Patent Claims

1. Device for applying a coating mass consisting of a liquid resin and fine-grained abrasive material, corundum in particular, onto a moving paper web that is intended for use in the production of abrasion-resistant laminates,

   with a deflection roller on which the paper web lies in a looping around region,

   with a metering roller that is placed parallel to the deflection roller and, with it, encloses a narrow gap,

   with a slotted nozzle for applying the coating mass either directly onto the paper web lying on the deflection roller, or onto the metering roller,

   and with an apparatus for leveling the freshly applied coating mass,
   characterized in that the leveling apparatus (8) includes at least one texturing roller (9, 9a), the enveloping surface of which has a screw thread-like pattern.

2. Device according to Claim 1, characterized in that the texturing roller (9, 9a) is provided with a multiple-start screw thread.

3. Device according to Claim 1 or 2, characterized in that the texturing roller (9, 9a) [is provided with] a system of helical grooves that cross one another.

4. Device according to one of the Claims 1 through 3, characterized in that the leveling apparatus (8) includes at least two texturing rollers (9, 9a).

5. Device according to one of the Claims 1 through 4, characterized in that leveling apparatus (8) includes a doctor blade (15), which is placed in the web path before or after the texturing roller(s) (9, 9a) and which exhibits an essentially rectangular flap (16), which is made of a flexible, rubber-like material and which is fastened on one side at its rearward edge, which is parallel to the axis of the texturing roller(s) (9, 9a), and lies slack on the wind-off upper free-running section of the paper web (1) as it leaves the deflection roller (2).

6. Device according to one of the Claims 1 through 5, characterized in that the leveling apparatus (8) includes a smooth roller (10) that is placed behind the texturing roller(s) (9, 9a) in the direction of web travel.

7. Device according to one of the Claims 1 through 6, characterized in that support mechanisms (2, 11) for the paper web (1) are placed a short distance ahead of and behind the region in which the leveling apparatus (8) contacts the paper web (1).

8. Device according to Claim 7, characterized in that the deflection roller (2) forms one support mechanism and that an additional support roller (11) is provided as the second support mechanism.

9. Device according to one of the Claims 1 through 8, characterized in that, with horizontal guiding of the wind-off free-running section of the paper web (1) as it leaves the deflection roller (2), the metering roller (6) is placed vertically or nearly vertically above the deflection roller (2).

10. Device according to one of the Claims 1 through 9, characterized in that a doctor blade (18) is assigned to the metering roller (6).

Figure 1

Figure 2

[see Figures 1 - 4]

Figure 3

Figure 3a

Figure 4

Figure 5

[see Figures 5 - 7]

Figure 6

Figure 7

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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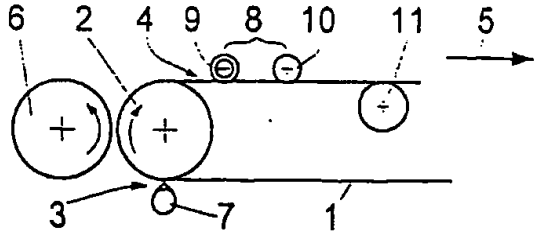
(54) Vorrichtung zum Auftragen einer abrasiven Beschichtungsmasse auf eine durchlaufende Papierbahn

(57) Es ist bekannt, auf eine durchlaufende Papierbahn eine Beschichtungsmasse, die abrasive Partikel enthält, mit einer Schlitzdüse im Überschuß aufzutragen, mit einer Dosierwalze zu dosieren und mittels eines einseitig befestigten Lappens aus flexiblem Material, der schlaff auf der durchlaufenden Papierbahn aufliegt, zu egalisieren. Es hat sich aber gezeigt, daß es je nach der Konsistenz der Beschichtungsmasse nicht immer gelingt, ein durch Oberflächenspannung bedingtes ungleichmäßiges Beschichtungsprofil so zu glätten, daß ein unerwünschtes Streifenmuster nicht mehr sichtbar ist.

Bei der neuen Vorrichtung umfaßt die Egalisiereinrichtung (8) eine Strukturwalze (9), deren Hüllfläche eine gewindeartige Struktur hat. Dadurch werden die durch ein ungleichmäßiges Beschichtungsprofil bedingten Längsstreifen seitlich verwischt, so daß sie am fertigen Produkt nicht mehr erkennbar sind.



Figur 1

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[0021] Die nachgeschaltete glatte Walze 10, die ebenfalls mit hoher Geschwindigkeit rotiert, bewirkt noch eine weitere Vergleichmäßigung.

[0022] Durch die Umlenkwalze 2 und die in relativ kurzem Abstand angeordnete Stützwalze 11 wird der Durchhang der Papierbahn 1, die in Betrieb üblicherweise unter einer gewissen Zugspannung steht, im Bereich der Egalisiereinrichtung 8 auf ein unmerkliches Maß reduziert.

[0023] Bei der Vorrichtung gemäß Figur 1 kann auch als Strukturwalze 9 eine Walze eingesetzt werden, deren Hüllfläche die in Figur 7 veranschaulichte Struktur hat. Hierbei wird das in den Streifen akkumulierte Beschichtungsmaterial durch die —in Richtung der Oberflächengeschwindigkeit gesehen- vorderen, in Bezug auf die Oberflächengeschwindigkeit schiefwinkligen Kanten der rautenförmigen Inseln 14 teils zur einen und teils zur anderen Seite abgetragen. Dadurch wird eine gleichmäßige Verteilung erreicht.

[0024] Von dem soeben beschriebenen Ausführungsbeispiel gemäß Figur 1 unterscheidet sich das in Figur 2 veranschaulichte Ausführungsbeispiel insbesondere dadurch, daß die Egalisiereinrichtung 8 zwei hintereinander angeordnete Strukturwalzen 9, 9a umfaßt. Ein weiterer Unterschied besteht darin, daß die Schlitzdüse 7 der Dosierwalze 6 zugeordnet ist.

[0025] Bei dem Ausführungsbeispiel gemäß Figur 3 umfaßt die Egalisiereinrichtung ein Rakel 15, welches im Bahnlauf vor der Strukturwalze 9 angeordnet ist. Es besteht aus einem im wesentlichen rechteckigen Lappen 16 aus flexiblem, gummiartigem Material, der an seiner rückwärtigen, zur Achse der Strukturwalze 9 parallelen Kante einseitig an einer Halteleiste 17 befestigt ist und schlaff auf dem von der Umlenkwalze 2 ablaufenden oberen Trum der Papierbahn 1 aufliegt. Der Lappen 16 bewirkt schon eine gewisse Voregalisierung. Weiterhin unterscheidet sich das Ausführungsbeispiel nach Figur 3 von den vorher erörterten Ausführungsbeispielen dadurch, daß der Dosierwalze 6 ein ähnliches Rakel 18 zugeordnet ist. Die zugehörige Halteleiste 19 ist schräg über der Dosierwalze 6 angeordnet, und zwar an der Seite, die der Umlenkwalze 2 abgekehrt ist. Daran ist ein flexibler rechteckiger Kunststofflappen 20 einseitig aufgehängt. Der vordere Teil des Lappens liegt schlaff auf der Dosierwalze 6 auf. Durch den Lappen 20 wird die an der Dosierwalze 6 anhaftende Beschichtungsmasse egalisiert. Dadurch wird verhindert, daß ein ungleichmäßiges Profil der an der Dosierwalze 6 anhaftenden Schicht auf die Beschichtung der Papierbahn 1 übertragen wird.

[0026] Das durch Figur 3 a veranschaulichte Ausführungsbeispiel unterscheidet sich von dem der Figur 3 dadurch, daß das Rakel 15 —in Laufrichtung gesehen- hinter der Strukturwalze 9 angeordnet ist, so daß der Lappen 16 über der Stützwalze 11 auf der Papierbahn 1 aufliegt. Etwaige hinter der Strukturwalze 9 noch sichtbare, schräg verlaufende Streifen werden durch den Lappen 16 geglättet.

[0027] Bei dem Ausführungsbeispiel gemäß Figur 4 ist die Dosierwalze 6 nahezu senkrecht —etwa in der Elfuhr-Position- über der Umlenkwalze 2 angeordnet. Daher durchläuft die Papierbahn zwischen Dosierung und Egalisierung nur eine relativ kurze Strecke und benötigt dafür nur ein entsprechend kurzes Zeitintervall. Das hat, wie Versuche ergeben haben, einen positiven Einfluß auf die Egalisierung.

Patentansprüche

1. Vorrichtung zum Auftragen einer aus flüssigem Harz und feinkörnigem abrasivem Material, insbesondere Korund, bestehenden Beschichtungsmasse auf eine durchlaufende Papierbahn, die zur Verwendung bei der Herstellung abriebfester Laminate bestimmt ist,

   mit einer Umlenkwalze, an der die Papierbahn in einem Umschlingungsbereich anliegt,

   mit einer Dosierwalze, die parallel zur Umlenkwalze angeordnet ist und mit ihr einen engen Spalt einschließt,

   mit einer Schlitzdüse zum Auftragen der Beschichtungsmasse entweder direkt auf die an der Umlenkwalze anliegende Papierbahn oder auf die Dosierwalze,

   und mit einer Einrichtung zum Egalisieren der frisch aufgetragenen Beschichtungsmasse,

   dadurch gekennzeichnet, daß die Egalisiereinrichtung (8) mindestens eine Strukturwalze (9, 9a) umfaßt, deren Hüllfläche eine gewindeartige Struktur hat.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Strukturwalze (9, 9a) mit einem mehrgängigen Gewinde versehen ist.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Strukturwalze (9, 9a) mit einem System von einander kreuzenden schraubenlinienförmigen Nuten.

4. Vorrichtung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Egalisiereinrichtung (8) mindestens zwei Strukturwalzen (9, 9a) umfaßt.

5. Vorrichtung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Egalisiereinrichtung (8) ein Rakel (15) umfaßt, welches im Bahnlauf vor oder hinter der (den) Strukturwalze (n) (9, 9a) angeordnet ist und einen im wesentlichen rechtwinkeligen Lappen (16) aus flexiblem, gummiartigem Material aufweist, der an seiner rückwärti-

gen, zur Achse der Strukturwalze (n) (9, 9a) parallelen Kante einseitig befestigt ist und schlaff auf dem von der Umlenkwalze (2) ablaufenden oberen Trum der Papierbahn (1) aufliegt.

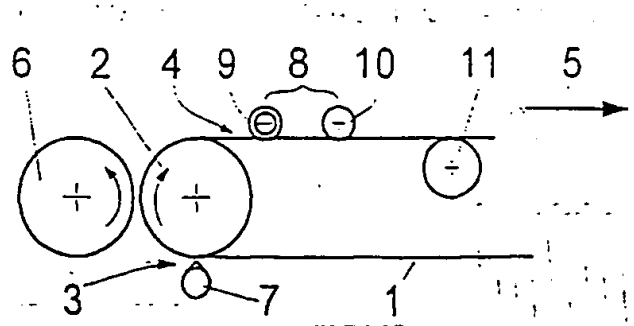
6. Vorrichtung nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Egalisiereinrichtung (8) eine glatte Walze (10) umfaßt, die in Bahnlaufrichtung hinter der (den) Strukturwalze (n) (9, 9a) angeordnet ist.

7. Vorrichtung nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß in kurzem Abstand vor und hinter dem Bereich, in dem die Egalisiereinrichtung (8) an der Papierbahn (1) angreift, Stützorgane (2, 11) für die Papierbahn (1) angeordnet sind.

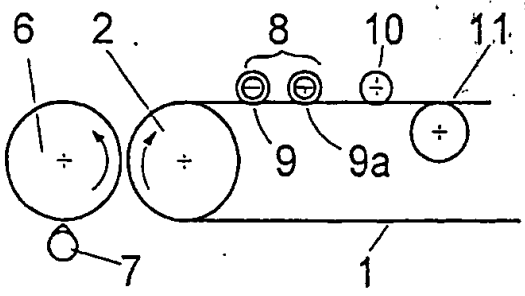
8. Vorrichtung nach Anspruch 7, dadurch gekennzeichnet, daß die Umlenkwalze (2) das eine Stützorgan bildet und das als zweites Stützorgan eine zusätzliche Stützwalze (11) vorgesehen ist.

9. Vorrichtung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß bei waagerechter Führung des von der Umlenkwalze (2) ablaufenden Trums der Papierbahn (1) die Dosierwalze (6) senkrecht oder nahezu senkrecht über der Umlenkwalze (2) angeordnet ist.

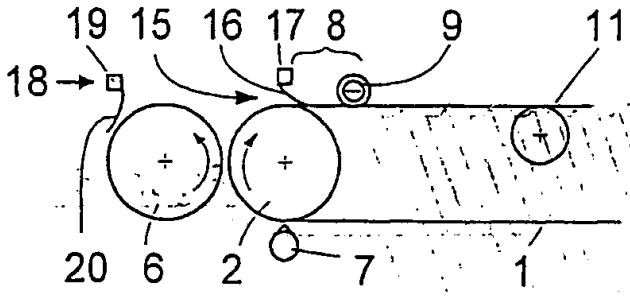
10. Vorrichtung nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß der Dosierwalze (6) ein Rakel (18) zugeordnet ist.



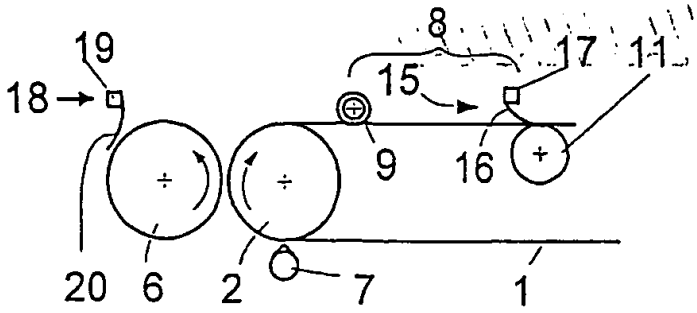
Figur1



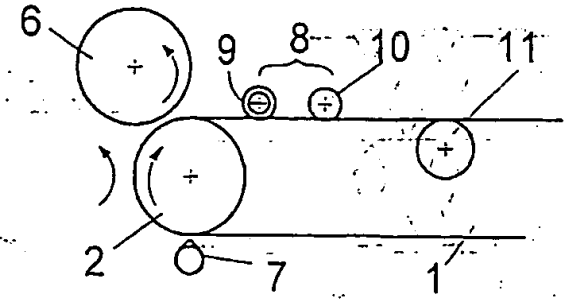
Figur2



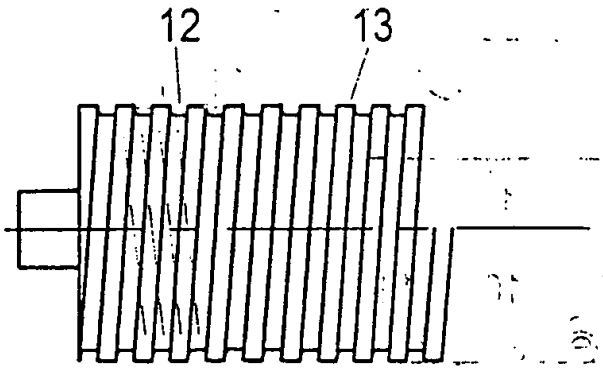
Figur3



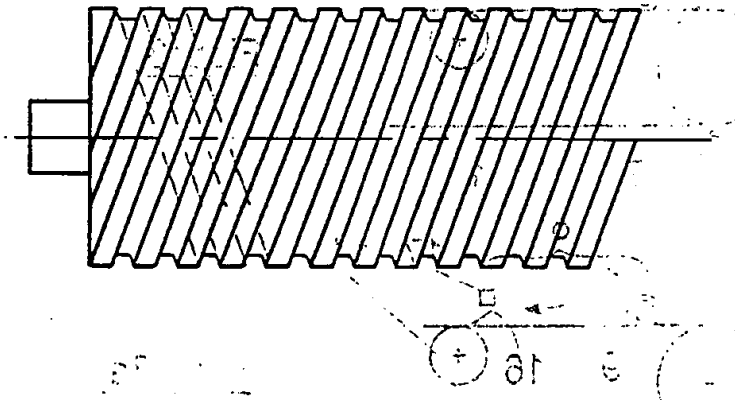
Figur 3a



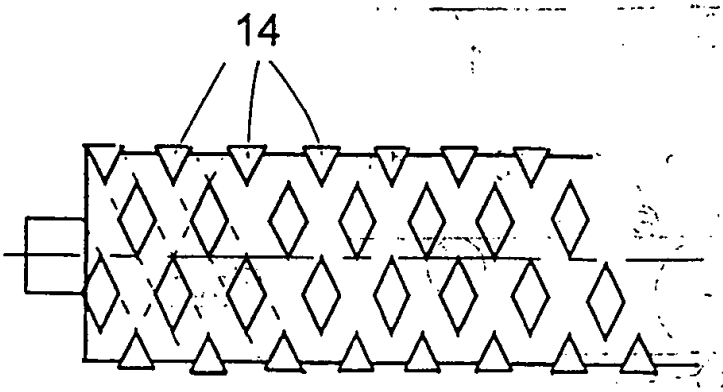
Figur4



Figur 5



Figur 6



Figur 7

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